

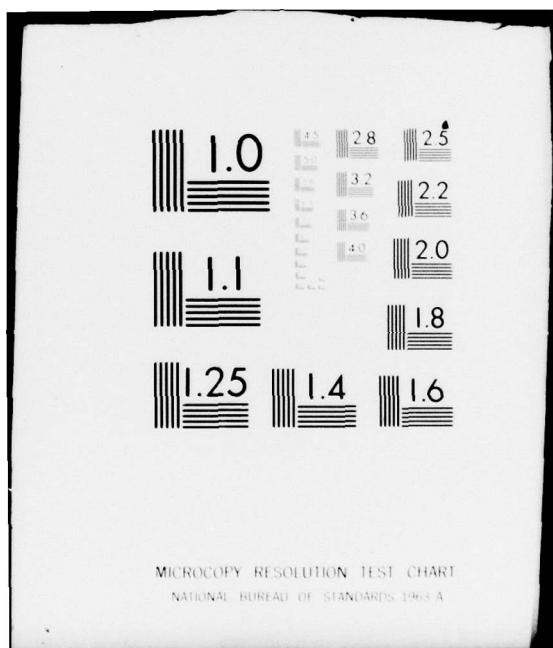
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NATIONAL DAM INSPECTION PROGRAM. KELSEY CREEK DAM (NDI I.D. NUM--ETC(U)
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⑥ National Dam Inspection Program. Kelsey Creek Dam

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIoga COUNTY

PENNSYLVANIA.

Phase I Inspection Report

KELSEY CREEK DAM

~~NDI ID. NAM~~ PA-00031
~~DER ID. NO.~~ 59-64
~~SCS ID.~~ PA-600

Number
BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

15) DACW31-79-C-0015

Prepared by

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
P.O. Box 1963
Harrisburg, Pennsylvania 17105

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DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

SUSQUEHANNA RIVER BASIN

KELSEY CREEK, TIoga COUNTY

PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031

DER ID No. 59-64

SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

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2	Plan and Typical Section.
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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam: Kelsey Creek
NDI ID No. PA-00031/DER ID No. 59-64
SCS ID No. PA-600

Owner: Borough of Wellsboro

State Located: Pennsylvania

County Located: Tioga

Stream: Kelsey Creek

Date of Inspection: 26 July 1979

Inspection Team: Gannet Fleming Corddry and
Carpenter, Inc.
Consulting Engineers
P.O. Box 1963
Harrisburg, Pennsylvania 17105

[Handwritten note: Cont'd from p. 2]

Based on visual inspection, available records, calculations and past operational performance, Kelsey Creek Dam is judged to be in good condition. The existing spillway can pass the Probable Maximum Flood (PMF) without overtopping of the dam. The spillway capacity is rated as adequate.

There is a slope stability analysis for the embankment, and it indicates that the embankment has adequate factors of safety. There is no evidence of significant problems threatening the embankment.

No deficiencies were noted during the visual inspection.

The following measure is recommended to be undertaken by the Owner, without delay:

(1) Implement an inspection of the main spillway conduit and riser to determine if separation of the conduit joints and cavitation damage to the riser have occurred. If pool conditions prevent the implementation of the inspection, the pool should be drawn down as required to provide the opportunity for inspection. This may require removing riprap at the impact basin endsill to lower tailwater.

In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Kelsey Creek Dam.

(2) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

Submitted by:



GANNETT FLEMING CORDDRY
AND CARPENTER, INC.,

Frederick Futchko
FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 17 September 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF
ENGINEERS

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 25 Sep 79

KELSEY CREEK DAM



Overview

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Kelsey Creek Dam consists of a zoned, earthfill embankment that is 860 feet long and 66 feet high at maximum section. The main spillway is a drop spillway located near the center of the embankment. It consists of a concrete riser that connects to a 36-inch diameter reinforced concrete pipe under the embankment. One 2-foot by 2.25-foot orifice is located in the front of the riser. The orifice crest is 39.2 feet below the design top of the dam elevation. The top of the riser is 19.7 feet below the design top of dam elevation. A platform and trashrack are provided above the riser. The outlet works is located at the main spillway. It consists of a 21-inch diameter steel pipe extending upstream from the main spillway riser. A 21-inch sluice gate is provided at the downstream end of the pipe, which outlets into the bottom of the riser.

The auxiliary spillway is at the right abutment of the dam. It is a grass-lined excavation in earth. At the control section, the auxiliary spillway has an earthen crest that is 250 feet long and 6.2 feet below the design top elevation of the dam and 13.5 feet above the top of the main spillway riser. The various features of the dam are shown on the Plates at the end of the report and on the Photographs in Appendix D.

b. Location. The dam is located on Kelsey Creek, approximately 1.0 mile southwest of Wellsboro, Pennsylvania. Kelsey Creek Dam is shown on the 1971 photorevision to USGS Quadrangle, Antrim, Pennsylvania, with coordinates N $41^{\circ}44'05''$ - W $77^{\circ}18'50''$, in Tioga County, Pennsylvania. The location map is shown on Plate 1.

c. Size Classification. Intermediate (66 feet high, 795 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Kelsey Creek Dam (Paragraph 5.1c.).

e. Ownership. Borough of Wellsboro, Wellsboro, Pennsylvania.

f. Purpose of Dam. Flood control.

g. Design and Construction History. Kelsey Creek Dam was planned under an agreement between the Borough of Wellsboro (Owner), the Soil Conservation Service of the U.S. Department of Agriculture (SCS), and the Tioga County Commissioners (TCC). Under this agreement, the Owner acquired title to the land, the SCS designed the dam, and the TCC supervised construction and maintains the dam. The dam was designed between 1964 and 1965 by the SCS. The permit to construct the dam was issued in 1965 and construction was started in 1965. The Contractor was C. Davis, Inc., Conshohocken, Pennsylvania. Construction of the dam under the supervision of Raymond Tipple, contracting officer for the TCC. The Chief SCS inspector was Frederick Schuetz. Harlan Kemmerer, Jerome Ogden, and Floyd Graham were the Resident Inspectors for the SCS. In August 1966, the Contractor was declared in default. A contract to complete the dam was awarded in October, 1966 to Schwartz and Baker, Inc., Contractors, Clarks Summit, Pennsylvania. The dam was completed in 1967.

h. Normal Operational Procedure. The reservoir is normally maintained at the crest of the orifice in the main spillway riser. The gate on the outlet works is normally closed.

1.3 Pertinent Data.

a. <u>Drainage Area.</u> (square miles)	3.14
b. <u>Discharge at Damsite.</u> (cfs.)	
Maximum known flood at damsite (June 1972)	190
Outlet works at normal pool elevation	80
Spillway capacity.	
Orifice with pool at main spillway riser crest	100
Main spillway with pool at auxiliary spillway crest	160
Auxiliary spillway with pool at top of dam	10,480

c.	<u>Elevation.</u> (feet above msl.)	
	Top of dam	1440.2
	Maximum pool	1440.2
	Normal pool (crest of orifice in main spillway riser)	1401.0
	Upstream invert outlet works	1383.0
	Downstream invert outlet works	1382.0
	Streambed at toe of dam	1374.5
d.	<u>Reservoir Length.</u> (miles)	
	Normal pool	0.24
	Maximum pool	0.71
e.	<u>Storage.</u> (acre-feet)	
	Normal pool	40
	Maximum pool	795
f.	<u>Reservoir Surface</u> (acres)	
	Normal pool	5
	Maximum pool	37.7
g.	<u>Dam.</u>	
	<u>Type</u>	Zoned earthfill
	<u>Length</u> (feet)	860
	<u>Height</u> (feet)	66
	<u>Topwidth</u> (feet)	20
	<u>Side Slopes</u>	
	Upstream	1V on 3H. There is a 10-foot berm at El. 1401.0
	Downstream	1V on 3H.

g. Dam. (Continued)

	<u>Zoning</u>	Impervious core up to el. 1408.0. Semiper-vious fill surround-ing core. More perv-ious fill at outside of embank-ment section.
	<u>Cutoff</u>	Impervious fill in cutoff trench.
	<u>Grout Curtain</u>	None
h.	<u>Diversion and Regulating Tunnel</u>	None
i.	<u>Spillway.</u> <u>Main (Principal or Service)</u>	Drop spillway
	<u>Type</u>	Vertical rectangular riser 3.0 feet by 9.0 feet, with rounded crest. One 2-foot high by 2.25 foot long orifice is located in the front of the riser. The riser connects to a conduit.

i. Spillway (continued)

<u>Length of Weir</u> (feet)	
Orifice	One at 2.25
Riser	Two at 9.0
<u>Crest Elevation</u>	
Orifices	1401.0
Top of Riser	1420.5
<u>Upstream Channel</u>	Reservoir, a platform is 1.5 feet above the riser.
<u>Conduit</u>	
<u>Type</u>	Reinforced concrete pipe, 3.0 feet in diameter, on concrete cradle.
<u>Length</u> (feet)	314.3
<u>Elevation</u>	
Upstream invert at riser	1380.0
Downstream invert	1374.5
<u>Downstream Channel</u>	Impact basin at natural stream.
<u>Auxiliary (Emergency) Spillway</u>	
<u>Type</u>	Grass-lined earthen cut with 1V on 2.5H side slopes.
<u>Length of Weir</u> (feet)	250 at earthen control section.
<u>Crest Elevation</u>	1434.0

i. Spillway (continued)

<u>Upstream Channel</u>	Grass-lined channel to reservoir.
<u>Downstream Channel</u>	Grass-lined channel extending to overbank.
j. <u>Regulating Outlets.</u>	
<u>Type</u>	Steel pipe, 2 1-inch diameter, extending to main spillway riser.
<u>Length (feet).</u>	53
<u>Closure</u>	2 1-inch, unseating head, sluice gate in riser at downstream end of steel pipe.
<u>Access</u>	Operator on platform above main spillway riser.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. Almost complete design data are available. A summary of the available data is in Appendices A and C.

b. Design Features. The dam and appurtenances are described in Paragraph 1.2a. The design features are shown on the Plates at the end of the report and on the Photographs in Appendix D. The embankment is shown on Plates 2, 3, and 4, and on Photographs A and B. A plan of the subdrainage system is shown on Plate 5.

The main spillway is shown on Plates 6 and 7, and on Photograph C. The impact basin is shown on Photograph D. The auxiliary spillway is shown on Plates 2, 3, and 8 and on Photographs C, E, and F.

c. Design Considerations. Although the main spillway design has been used successfully by the SCS for many years, it appears that the entrance to the conduit could possibly develop cavitation during certain flow conditions. Other design considerations are discussed in Sections 5 and 6.

2.2 Construction.

a. Data Available. Construction data available consist of the construction specifications, construction photographs, and reports both from the resident inspector and from the periodic construction inspections by the Commonwealth. The only adverse item noted in these reports was the poor construction management by the first contractor, who was declared in default. No technical problems were noted during construction.

b. Construction Considerations. The available information indicates that the dam is well constructed.

2.3 Operation. There are formal records of operation maintained by the Tioga County Commissioners. All items noted therein are minor annual maintenance operations.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER), and by the SCS. The SCS made available the District Conservationist and the TCC made available maintenance personnel for information during the visual inspection. The SCS also researched their files for additional information upon request of the inspection team.

b. Adequacy. The type and amount of design data and other engineering data is good. The assessment is based on the combination of design data, visual inspection, and performance history.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The overall appearance of the dam is good with a few deficiencies as noted herein. The locations of deficiencies are shown in Appendix B on Plate B-1. Survey data acquired during this inspection are presented in Appendix B. On the day of the inspection, the pool was at the crest of the orifice in main spillway riser.

b. Embankment. The embankment is in good condition. The grass cover is in excellent condition. The grass is at least 3 feet high in all areas. The upstream slope is protected by grass. A foot trail is worn in the berm at Elevation 1401.0 on the upstream slope. An area about 200 feet to the left of the main spillway riser is eroded to a maximum depth of 3 inches. The area is 12 feet wide and 20 feet long; it is about 2 feet above normal pool. The grass is not completely established in this area. A survey performed for this inspection reveals that the embankment is at or above the design top elevation and that the slopes are in accordance with the design drawings. No seepage was observed at or downstream from the dam.

c. Appurtenant Structures. The outlet works is in good condition, however its functioning was not observed on the day of the inspection. The SCS Representative stated that it had been previously operated during the annual inspection with no observed problems.

The main spillway riser is in good condition. The conduit beneath the embankment could not be inspected because it was flowing about one half full. A minor amount of debris was at the orifice of the main spillway riser. The impact basin is in good condition. Very minor spalling, of no concern, was observed at a few localized areas of the concrete. Because of the high tailwater, it was impossible to determine if the drain

pipes, which extend to the embankment toe drain, were discharging. The riprap downstream from the impact basin is in good condition. It appeared that someone had piled some of the riprap across the impact basin sill to create a pool at the impact basin.

The auxiliary spillway is in good condition, The grass cover is in good condition; it is at least 3 feet high. The survey performed for this inspection revealed that the control section invert is between 0.6 foot below to 0.5 foot above the design elevation. Because of the tall grass cover, it is uncertain that the measurements were made along the crest of the control section. This may explain part of the difference between the actual and design elevation.

d. Reservoir Area. The reservoir has fairly steep wooded slopes. The watershed is mostly wooded, rolling hills. There is minor rural development in the watershed. A small dam is upstream of Kelsey Creek Dam. Pertinent data are in Appendix C.

e. Downstream Channel. The stream extends about 1.0 mile through Wellsboro and beyond, to its confluence with Marsh Creek. In this reach there are at least 30 dwellings. The County Courthouse is also located adjacent to the stream along this reach. The access road to the dam is a public road extending far above and parallel to the reservoir along the left bank.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at the crest of the orifice in the main spillway riser, Elevation 1401.0, with excess inflow discharging over the crest and into Kelsey Creek. A 21-inch diameter steel pipe discharges water from the reservoir. Since the outlet works pipe is intended only for drawing down the reservoir, the gate on the Kelsey Creek Dam water discharge line is usually closed.

4.2 Maintenance of Dam. The dam is visited every three months by the caretakers who observe the condition of the dam. During periods of precipitation, the dam is visited more frequently. The caretakers are responsible for reporting any changes or deficiencies to the SCS. The TCC, with the assistance of the SCS, make a formal inspection of the dam each year, and the records are filed. Maintenance deficiencies are corrected shortly after the inspection. Informal inspections are also made when the SCS representative is on the site for other reasons. Mowing and brush cutting on the embankment is accomplished annually.

4.3 Maintenance of Operating Facilities. The gate on the outlet works pipe is operated annually. This policy was adopted by the SCS in 1978.

4.4 Warning Systems in Effect. The SCS Representative and the caretaker stated that there was no emergency operation and warning plan. They did note that the dam is monitored continuously during periods of heavy precipitation by members of the Local Fire Company, who maintain contact with the Local Civil Defense organization. The Borough has this policy for all dams in the vicinity.

4.5 Evaluation of Operational Adequacy. Maintenance of the dam is good. However, if the grass were allowed to grow much higher, it could become a hazard to the dam, because significantly higher grass could obstruct flows in the auxiliary spillway. Also, high grass has the potential to obscure deficiencies that might develop. Maintenance of the operating facilities is also good. The procedures used to inspect the dam are good, as is the correction of maintenance deficiencies. Because of the

low normal pool, the schedule of visits to the dam is adequate. It would be better practice to visit the dam more frequently. An emergency operation and warning system is a necessary safeguard to improve the safety of the dam and prevent loss of life downstream, should evidence of stress develop at the dam.

SECTION 5
HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. The hydrology and hydraulics of the design of the dam were based on standard SCS criteria. The crest of the orifice in the main spillway riser was determined by sediment requirements. The crest elevation of the main spillway riser was determined by routing the 100-year, 1-hour storm. The crest of the auxiliary spillway was set by routing the maximum 100-year, 6-hour storm. The design high water was determined by routing a storm equal to 1.25 times the above 100-year, 6-hour storm. The design high water storm was not used to determine the size of structures at the dam. The top of dam elevation and auxiliary spillway size were determined by routing the "Freeboard" storm, which is equal to twice the design high water storm (2.5 times the 100-year, 6-hour storm). The "Freeboard" storm is discussed in Paragraph 5.1d.

b. Experience Data. The maximum known flood at the damsite occurred during Tropical Storm Agnes in June 1972, when water was 2.0 feet below the auxiliary spillway crest. Using the design discharge ratings, the outflow is estimated at about 190 cfs.

c. Visual Observations.

(1) General. The visual inspection of Kelsey Creek Dam, which is described in Section 3, resulted in some observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The erosion on the upstream slope is minor. The SCS Representative reported that the erosion was caused by surface runoff immediately after construction, before the grass cover was established. The erosion has not progressed since the grass cover was established. The erosion is not considered a deficiency because it is slight and because it has not progressed since the dam was completed.

Using grass cover instead of riprap as slope protection for dams is not a universally used design criteria, but it is a standard SCS design criteria. Any potential erosion hazard is considered to be offset by the good maintenance at the dam. Any erosion of the embankment would be detected and repaired immediately after it occurred. This would make the erosion hazard negligible.

The conduit has not been inspected since the dam was completed. As the joints of concrete conduits founded on earth tend to spread apart, an inspection would be prudent. However, since the as-built information indicates that each conduit joint has an allowable elongation of at least 3 inches, the concern is only minor.

(3) Appurtenant Structures. The gate for the outlet works is located sufficiently far upstream to be considered an upstream closure facility. The riprap at the endsill of the impact basin raises tailwater slightly. This is not a hazard to the dam, but it does hinder visual inspection. The crest elevation of the auxiliary spillway indicates that the spillway capacity is slightly greater than the design computations indicate.

(4) Reservoir Area. No conditions were observed in the reservoir area or watershed that might present significant hazard to the dam. The assessment of the dam is based on existing conditions, and the effects of future development are not considered. Calculations in Appendix C concerning the small dam in the watershed indicate that the storage is small and its failure would not present a significant hazard to Kelsey Creek Dam.

(5) Downstream Conditions. No conditions were observed immediately downstream from the dam that would create significant hazard to the dam. If the dam should fail, a hazard to dwellings in Wellsboro would exist. Because of the possibility of flooding dwellings, a high hazard classification is warranted for Kelsey Creek Dam. The SCS designed the dam assuming that it was a Class C structure. This is essentially equivalent to a high hazard classification. Access to Kelsey Creek Dam is excellent.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE) for the size (Intermediate) and hazard potential (High) of Kelsey Creek Dam, the Spillway Design Flood (SDF) is the Probable Maximum Flood (PMF).

(2) Design Storm. The SCS "Freeboard" storm, which was used to determine the size of the auxiliary spillway and the top elevation of the dam, was not developed from PMF methods. However, the total rainfall of 20.5 inches is equivalent to a PMF rainfall for this area. The assumed losses of 3.5 inches are slightly higher than those established by criteria for the Susquehanna River Basin. The unit hydrograph used by the SCS is conservative. The computed peak inflow of 10,940 cfs is equivalent to a PMF peak inflow. The storm is an acceptable estimate of the PMF.

(3) Design Storm Routing. The design storm routing computations are in Appendix C. It should be noted that the SCS assumed the main spillway to be functional up to the top elevation of the dam. As the main spillway is not vented and as there is a potential of debris blocking the trashrack, it is uncertain that the main spillway could discharge at this capacity. However, the main spillway capacity is minimal when compared to the auxiliary spillway capacity, and any reduction would have a negligible effect on the PMF routing. It should be noted that the crest of the main spillway riser is 2 feet higher than the elevation in the design computations. Also, both the auxiliary spillway crest and the top of dam are 1 foot higher than the elevations in the design computations. The changes have a negligible effect on the PMF routing.

(4) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix C. Since Kelsey Creek Dam can pass the PMF, the spillway capacity is rated as adequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Kelsey Creek Dam, which is described in Section 3, resulted in some observations relevant to structural stability. These observations are evaluated herein for various features.

(2) Embankment. The erosion on the embankment is evaluated in Section 5.

(3) Appurtenant Structures. There are no observations relevant to structural stability at these structures.

b. Design and Construction Data. A stability analysis was performed by the SCS during the design of the dam. The stability analysis resulted in a minimum factor of safety of 1.43 on the upstream slope for the sudden drawdown condition and 1.55 on the downstream slope for the steady seepage condition. The design shear strength was based on the consolidated-undrained strength obtained from a triaxial shear test. These factors of safety are considered to be adequate. A summary is included in Appendix A.

c. Operating Records. There are formal records of operation. No stability problems have occurred over the operational history of the dam.

d. Postconstruction Changes. There have been no postconstruction changes to Kelsey Creek Dam.

e. Seismic Stability. Kelsey Creek Dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone has adequate factors of safety under static loading conditions, it can be assumed safe for any expected earthquake loading. Since the factors of safety are adequate, the dam is assumed to be stable for any expected earthquake loading.

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND
PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on visual inspection, available records, calculations, and past operational performance, Kelsey Creek Dam is judged to be in good condition. The spillway can pass the PMF without overtopping of the dam. The spillway capacity is rated as adequate.

(2) There is a stability analysis for the embankment, and it indicates that the embankment has adequate factors of safety. There is no evidence of problems threatening the embankment.

(3) No deficiencies were noted during the visual inspection.

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented without delay.

d. Necessity for Further Investigations. Accomplishment of the remedial measures outlined in Paragraph 7.2 will not require further investigations by the Owner.

7.2 Recommendations and Remedial Measures.

a. The following measure is recommended to be undertaken by the Owner, without delay:

(1) Implement an inspection of the main spillway conduit and riser to determine if separation of the conduit joints and cavitation damage to the riser have occurred. If pool conditions prevent the

implementation of the inspection, the pool should be drawn down as required to provide the opportunity for inspection. This may require removing riprap at the impact basin endsill to lower tailwater.

b. In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Kelsey Creek Dam.

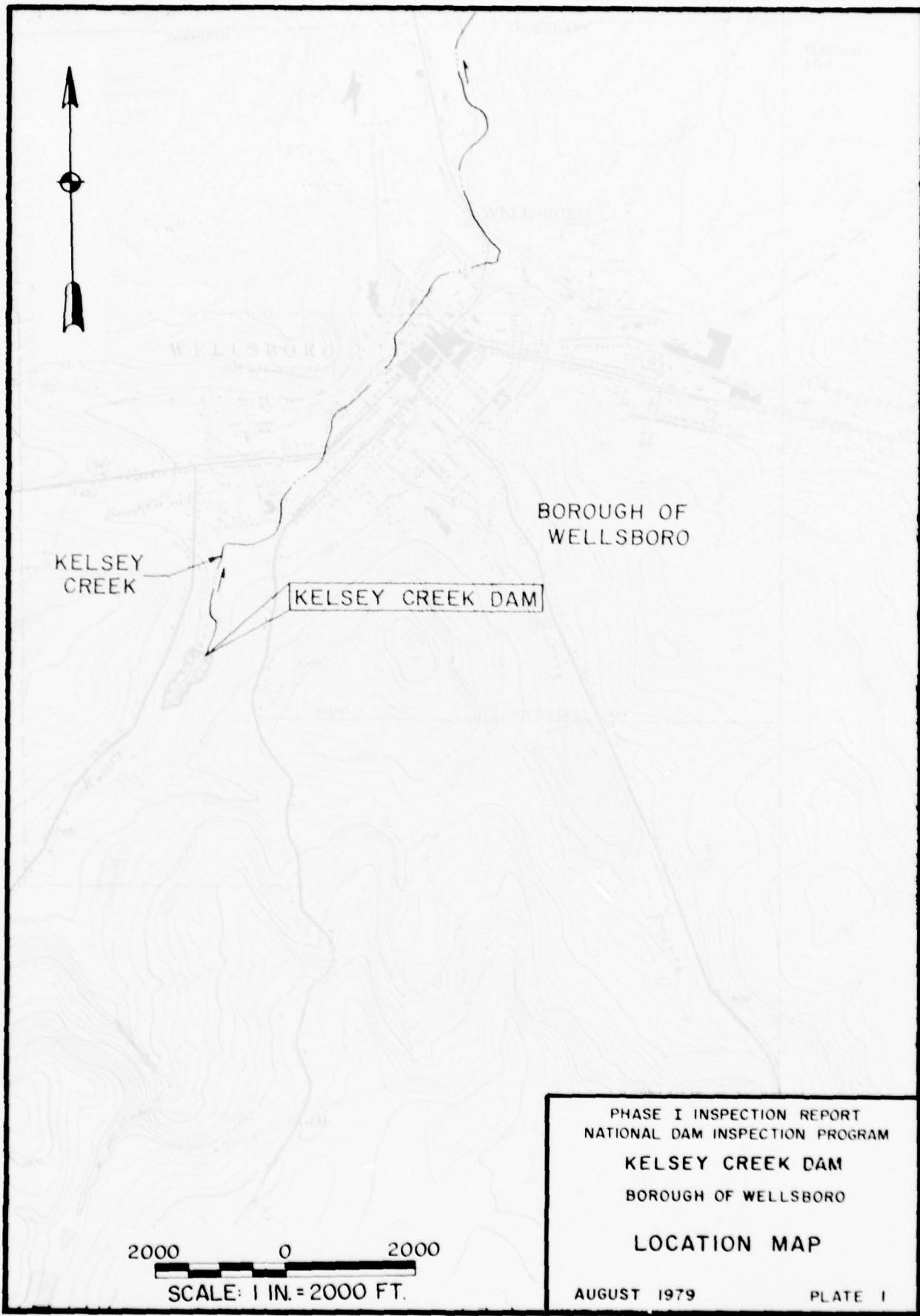
(2) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM
NDI ID No. PA-00031
DER ID No. 59-64
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BOROUGH OF WELLSBORO
PHASE I INSPECTION REPORT
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AUGUST 1979

PLATES



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NATIONAL DAM INSPECTION PROGRAM
KELSEY CREEK DAM
BOROUGH OF WELLSBORO

LOCATION MAP

AUGUST 1979

PLATE I

THE RIVER LINE TO BE
PLANTED BY OTHERS

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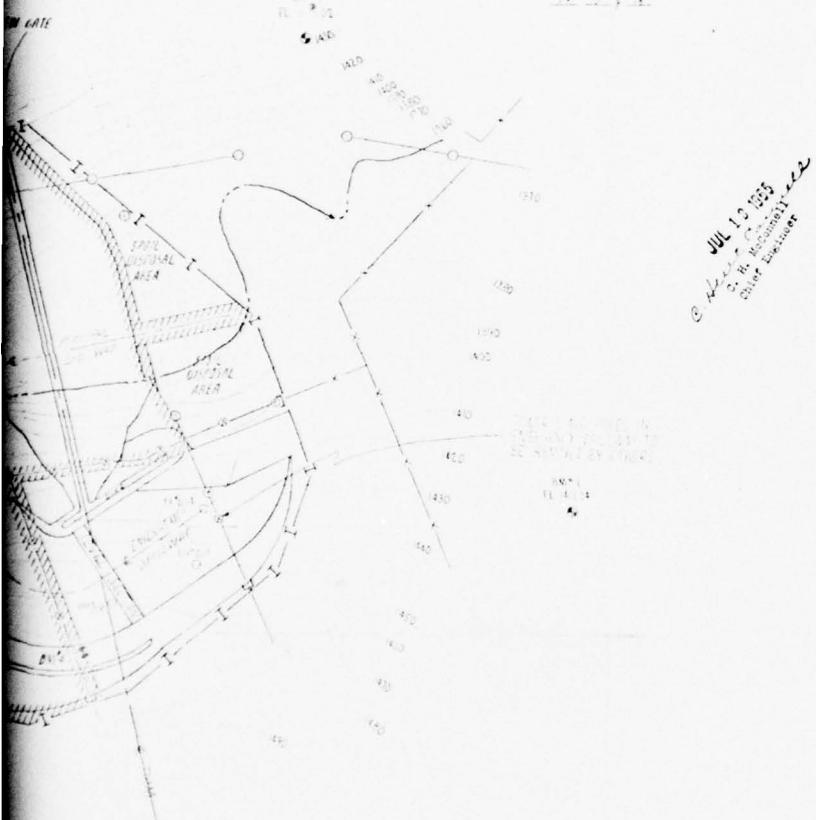
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SEE REPORT NO. _____
Div. Date _____

59-14-7A
FILE NUMBER
RECEIVED IN THE OFFICE OF THE WATER & POWER
RESOURCES BOARD - DEPARTMENT OF FORESTS &
WATERS ON THE DAY OF JULY 12, 1955
C. E. Strode
FILE NUMBER

AREA TO BE HELD UNTIL DAY OF EMERGENCY
INCLUDES HIGH VOLUME AREA AND DISTURBED AREA
IN TRACT # 258

_____ AREA TO BE CLEARED AND RESTORED - SEE NOTES
_____ AREA TO BE CLEARED - SEE NOTES

PLAN OF TEE AND DELL AREA - SEE NOTES
24-2-8-4



LEGEND

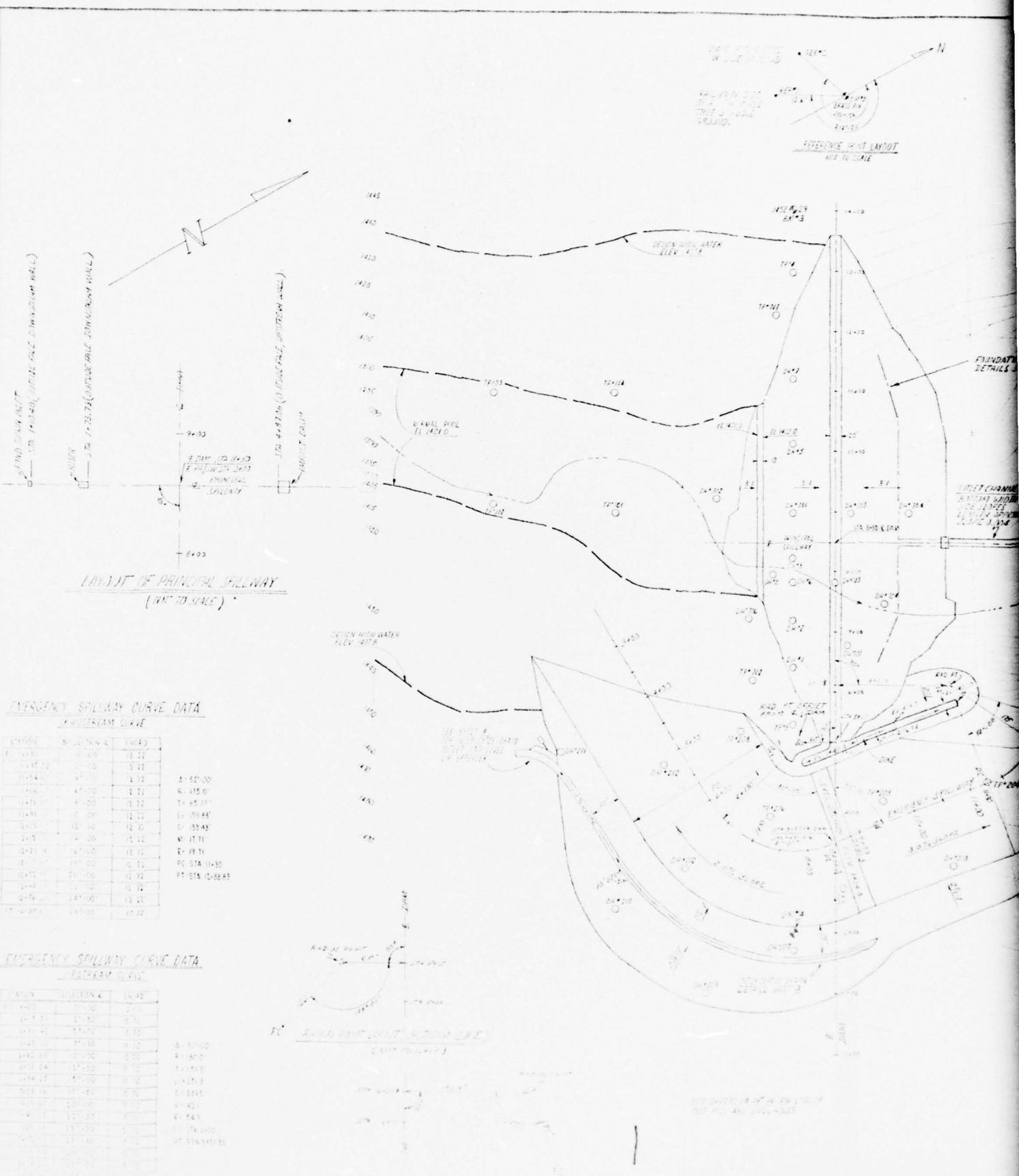
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- STUDY LINE
- MANUFACTURED

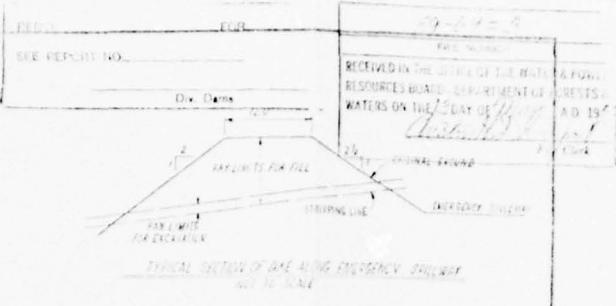
MARSH CREEK WATERSHED
FLOODWATER RETARDING DAM PA-600
TIoga County, Pennsylvania
PLAN OF STORAGE AREA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

KELSEY CREEK DAM
BOROUGH OF WELLSBORO

PLAN AND TYPICAL SECTION





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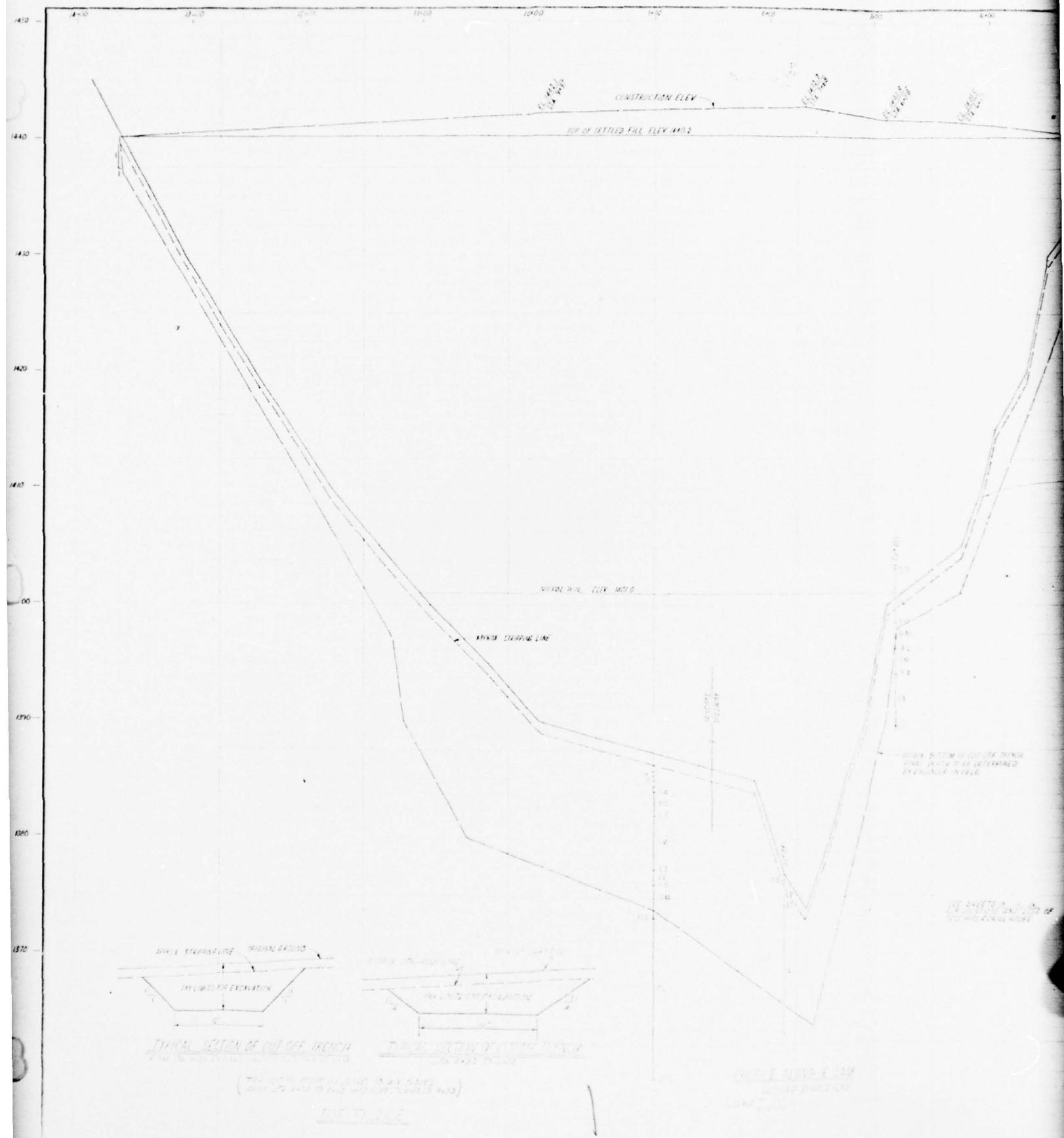
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57-64-5	FILE NUMBER
RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES, WILMINGTON, DELAWARE, WATERS ON THE 20TH DAY OF JULY A.D. 1965	
<i>John H. Miller, Clerk</i>	
REC'D	FOR
SEE REPORT NO.	
D.V.C.	

© JUL 12 1965
S. B. McNeely
Chair Engineer

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-42

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-46



NOTE: BOTTOM OF CUTTING SPURSHALL BE LOCATED IN
FINE GRAINED CLAY (CL. 3) LAYERED AS 10 CM.
VARIED IN THICKNESS AND TEST UNLOAD IN DRILL
HOLE 105.

2

MARSH CREEK WATERSHED FLOODWATER RETARDING DAM PA-600 TIoga County, Pennsylvania	
PROFILE ALONG E OF DAM	
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
<i>John H. Miller, Clerk</i>	

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

KELSEY CREEK DAM

BOROUGH OF WELLSBORO

PROFILES

C. DA FILTER PLANT SITE (CONT'D)

- 0 12" DRAINS
- 1 18" SEWER
- 1 8" SEWER
- 2 32" DRAINS (1/2)
- 1 32" DRAIN (1/2-1/2)
- 1 32" DRAIN (1/2)
- 1 METAL END CAP
- 1 SMALL ANIMAL CAGE (SEE SHEET 12)

Sheet 4 - DRAIN (See Sheet 10 for details)

MATERIAL SHEET
CONSTRUCTION SHEET

SOIL
ALL DRAINS ARE TO BE MADE IN SOIL
CLASS II, CONCRETE, AND TERRACOTTA, OR STONE

C. DA FILTER PLANT (CONT'D)

- 8 12" SEWER
- 1 18" SEWER
- 1 8" SEWER
- 2 32" DRAINS (1/2)
- 1 32" DRAIN (1/2-1/2)
- 1 32" DRAIN (1/2)
- 1 32" DRAIN (1/2)
- 1 METAL END CAP
- 1 SMALL ANIMAL CAGE (See Sheet 12)

Sheet 4 - DRAIN (See Sheet 10 for details)

PIPE FILTER	
PIPE NO.	SIZE (IN.)
P-4	10
P-5	10
P-6	10
P-7	10
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MATERIAL SHEET

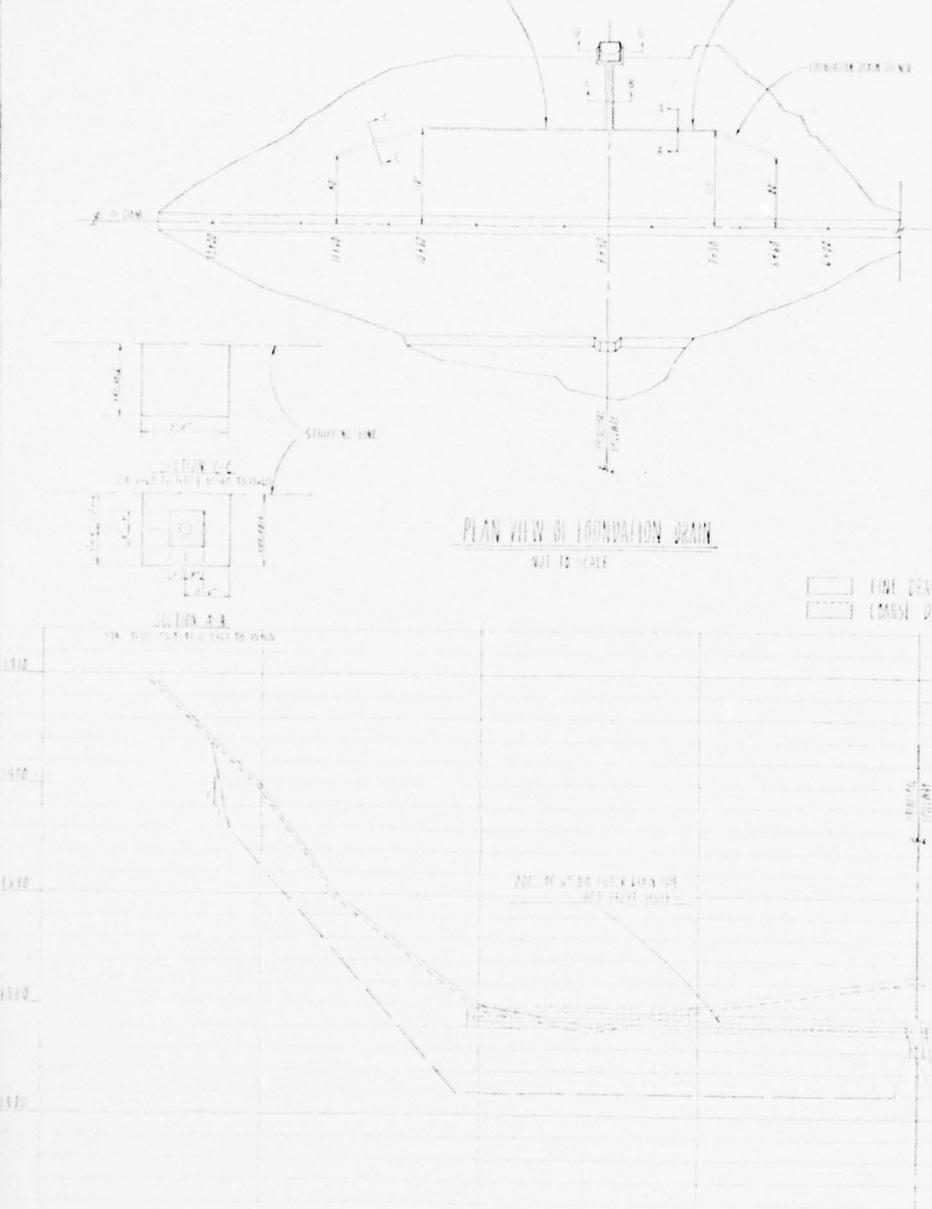
CONSTRUCTION SHEET

SOIL
ALL DRAINS ARE TO BE MADE IN SOIL
CLASS II, CONCRETE, AND TERRACOTTA, OR STONE

C. DA FILTER PLANT (CONT'D)

- 8 12" SEWER
- 1 18" SEWER
- 1 8" SEWER
- 2 32" DRAINS (1/2)
- 1 32" DRAIN (1/2-1/2)
- 1 32" DRAIN (1/2)
- 1 32" DRAIN (1/2)
- 1 METAL END CAP
- 1 SMALL ANIMAL CAGE (See Sheet 12)

Sheet 4 - DRAIN (See Sheet 10 for details)



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04-303

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PLAN VIEW
(NOT TO SCALE)



CONG ĐOÀN MỸ



RISER



CRADLE



ANTI-SEEP COLLAR



200 DAY

- TYPICAL SECTIONS -

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0439 L 2007 L 1307 06 777 P
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PEOPLE'S LINE OF NATIONAL SECURITY
(NATO LINE)

RECD	FOR	67-24-6
THE REPORT NO.		FILE NUMBER
D.D.		RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BUREAU, DEPARTMENT OF FORESTS WATERS ON THE DATE OF JULY 13, 1965 AD 1965 BY C.R. HARRIS, CHIEF ENGINEER FILED BY C.R. HARRIS

ESTIMATION OF DRAIN
WALL SHEET 1

DRYING AREA
TO BE DETERMINED
AND ESTIMATED
BY THE ENGINEER.



JUL 13 1965
C.R. Harris
Chief Engineer



APPROVED AND FORWARDED
FOR FURTHER REVIEW
BY THE
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PRESERVE AND USE
AND DO NOT REUSE
THIS DRAWING
FOR ANY OTHER PURPOSE
OR FOR ANY OTHER PROJECT

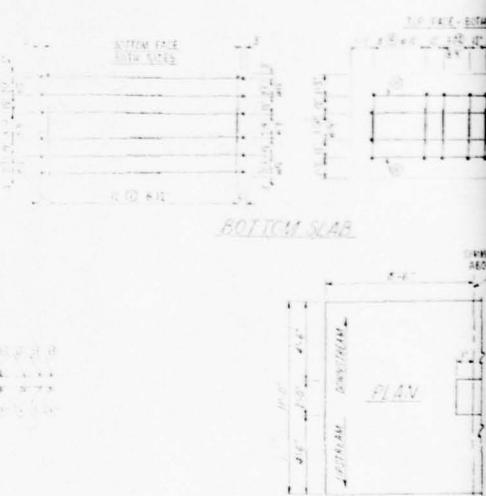
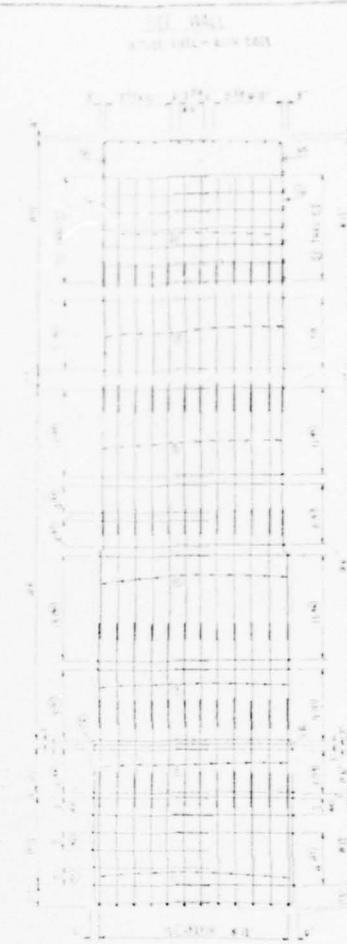
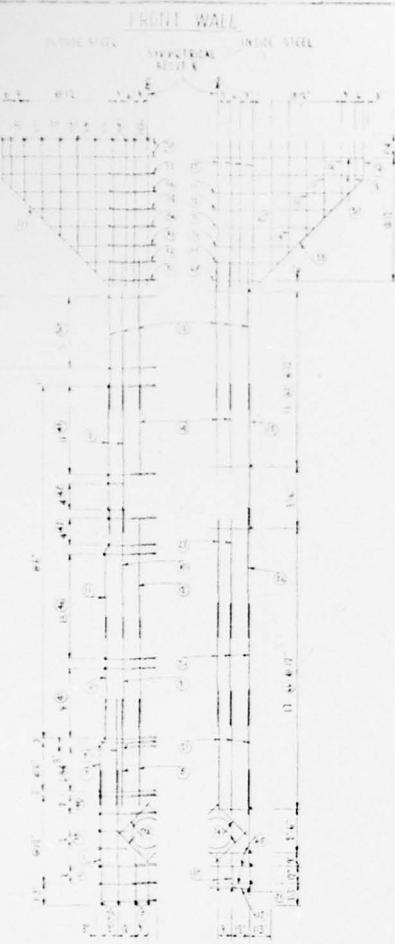
MARSH CREEK WATERSHED
FLOODWATER RETARDING DAM PA-600
TIoga County, Pennsylvania
PLAN-PROFILE OF PRINCIPAL SPILLWAY
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

KELSEY CREEK DAM

BOROUGH OF WELLSBORO

MAIN SPILLWAY AND
OUTLET WORKS



100-3211-0647-28

AD 45 5442	3
AD 55 5443	2
AD 1 5444	22
AD 2 5445	10
AD 3 5446	1
TOTAL	36

CON
CLASS 4000 L



BAR TYPES.

SEE SHEET 12 FOR GENERAL NOTES

JUL 12 1965
FBI - BOSTON
C. H. Macomber
G. J. F. E. M.

MARSH CREEK WATERSHED
FLOODWATER RETARDING DAM PA-600
TIoga County, Pennsylvania

STRUCTURAL DETAILS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designated Name & Address	Date	Approved by Date
Ross - R. A. STALTER	4-65	
Travel		Approved by Date
Amount (Block & Dime)	No. 8	PA-600-P
	15	

APRIL 1963

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

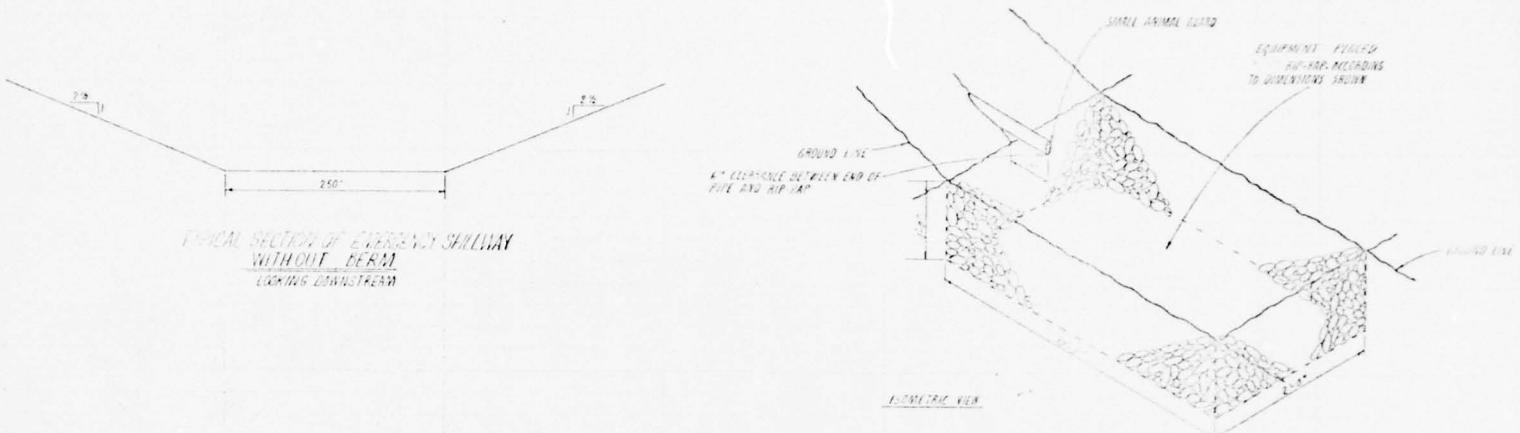
KELSEY CREEK DAM

BOROUGH OF WELLSBORO

MAIN SPILLWAY RISER

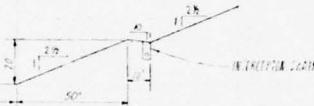
AUGUST 1979

PLATE 7

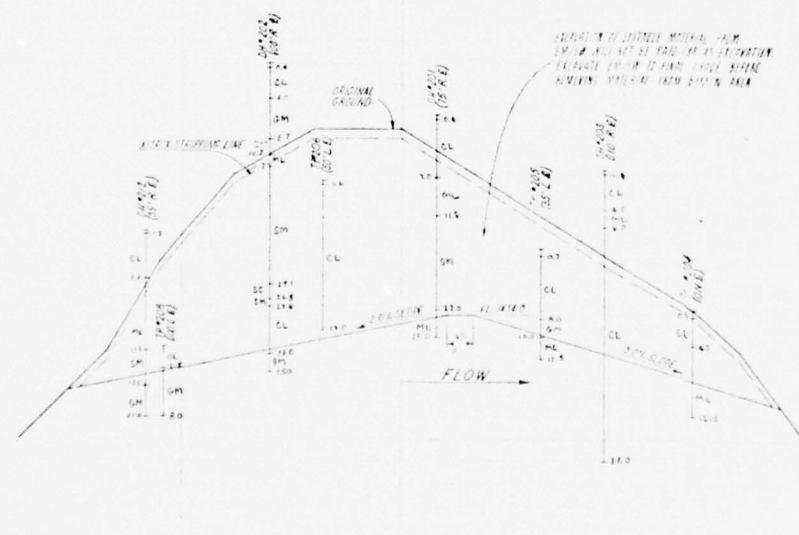


TYPICAL SECTION OF EMERGENCY SPILLWAY
WITH BERMS
LOOKING DOWNSTREAM

50'



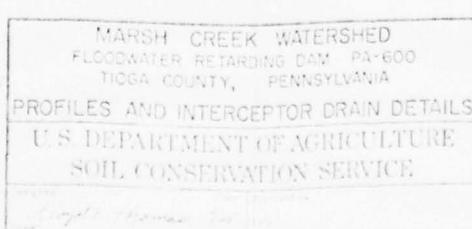
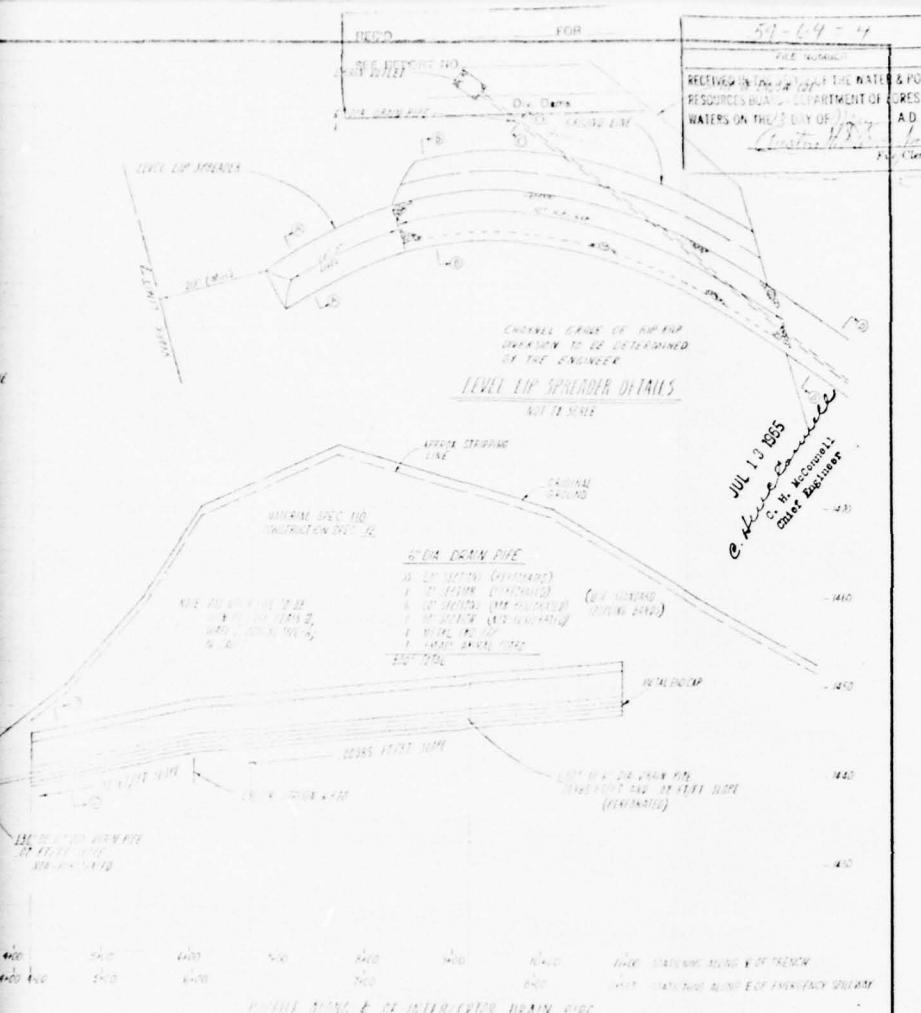
INTERFERING DRINK WATER
SOURCE



PROFILE ALONG E OF EMERGENCY SPILLWAY

SECTION E-E

SECTION A-A



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

KELSEY CREEK DAM

BOROUGH OF WELLSBORO

AUXILIARY SPILLWAY

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIoga COUNTY
PENNSYLVANIA

KELSEY CREEK DAM
NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600
BOROUGH OF WELLSBORO
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

APPENDIX A
CHECKLIST - ENGINEERING DATA

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Kelso Creek
NDI ID NO.: PA-00168 DER ID NO.: 59-64
Section No. PA-600

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	Available in CCS file.
REGIONAL VICINITY MAP	See Plate 1
CONSTRUCTION HISTORY	Built 1965 to 1967
TYPICAL SECTIONS OF DAM	See Plate 2
OUTLETS:	No discharge ratings
Plan Details Constraints Discharge Ratings	

A-1

ENGINEERING DATA

Sheet 2 of 4

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None
DESIGN REPORTS	COMPLETE DESIGN REPORT HIGHLIGHTED IN THE SCS FILES.
GEOLOGY REPORTS	SEE APPENDIX E
DESIGN COMPUTATIONS: Hydrology and Hydraulics (H&H) Dam Stability (STA) Seepage Studies	NO SEEPAGE STUDIES FOR H&H SEE APPENDIX C FOR STA SEE SECTION OF THIS APPENDIX
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	COMPLETE ANALYSIS IN SCS FILES
POSTCONSTRUCTION SURVEYS OF DAM	None OTHER THAN AS-BUILT DRAWINGS

ENGINEERING DATA

Sheet 3 of 4

ITEM	REMARKS
BORROW SOURCES	Reservoir Area
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	TROPICAL STORM AGNES June 1972 Pool 2' below Aux Spillway crest
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM:	None
Description	
Reports	

ENGINEERING DATA

Sheet 4 of 4

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	IN Tioga County Files Oru/Minor Maintenance Operations
SPILLWAY: Plan Sections Details	SEE PLATES 7 & 8
OPERATING EQUIPMENT: Plans Details	DATA AVAILABLE IN SCS FILES.
PREVIOUS INSPECTIONS Dates Deficiencies	1965 by Penn DER - UNDER CONSTRUCTION 1972 - STONE IN OUTLET CHANNEL. 1975 - NO DEFICIENCIES 1977 - NO DEFICIENCIES 1978 - NO DEFICIENCIES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY
SUMMARY - SLOPE STABILITY ANALYSISMaximum Section
Sta 5+70State Pennsylvania Project Marsh Creek Site PA-600Date 11-20-64 Analysis Made By T.C.H.E.G.N. Checked By T.C.H.E.G.N.Method of Analysis Swedish Circle

Location of Material	Found		Found		Emb. 95% std	Emb. 95% std	Emb. 95% std
	CL	CL	SM	CL			
Sample No.	65W903	65W905	65W910	65W911	65W912		
γ_d	105.7	99.4	121.0	94.5	108.3		
γ_m	105	99	132.0	114.5	123.0		
γ_s	130.5	126.0	137.5	122.0	130.0		
γ_b	68.0	63.5	75.0	59.5	67.5		
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.
ϕ	125°	135°	145°	33.5°	230°	230°	
Tan ϕ	0.222	0.240	0.259	0.662	0.424	0.424	
K							
C	1000	1300	1000	150	425	500	

UPSTREAM SLOPE

Trial	Slope	Conditions	f_s
1	3:1	Full draw down - 10' berm - Arc cut from opp shldr thru * zoned emb only Sat shear values only	1.43
8	3:1	Full drawdown - 10' berm - Arc cut from opp shldr thru * zoned Emb only Sat. shear values only	
5			1.67

DOWNSTREAM SLOPE

Trial	Slope	Conditions	f_s
2	3:1	Nd drain - No berm - Arc cut from opp shldr thru * zoned emb only " - shear values only	1.55
2A	3:1	Same as #2 except drain @ 9% = 0.6	2.0

*Emb Zoning: CL on upstream
CL in core
SM downstream
see sketch.

A-5

From sheet 1 of 5 form 357
Marsh Creek S.t.cPA-600
Pennsylvania

#2
 $R = 185.0$

Maximum Section
Sta 5+70

#1

A-6

146.0

$R = 175.0$

143.40

141.0.2

141.20

140.1.0

138.0

137.6.7

CL or CL-HL
(E 34.500)

CL
(E 30.500)
(-123)

CL-E9

SM
(33.50-1.50)

YH:1

3.1

130.0 - 100.0'

C: 114.3'

126.0'

134.0

b = 120.5'

SOIL MECHANICS LABORATORY
SUMMARY - SLOPE STABILITY ANALYSISState Pennsylvania Project Marsh Creek Site PA-600Date 11-20-64 Analysis Made By JCH J AWL Checked By _____Method of Analysis Swedish Circle

Location of Material									
Sample No.									
γ_d									
γ_m									
γ_s									
γ_b									
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.
ϕ									
Tan ϕ									
K									
C									

UPSTREAM SLOPE

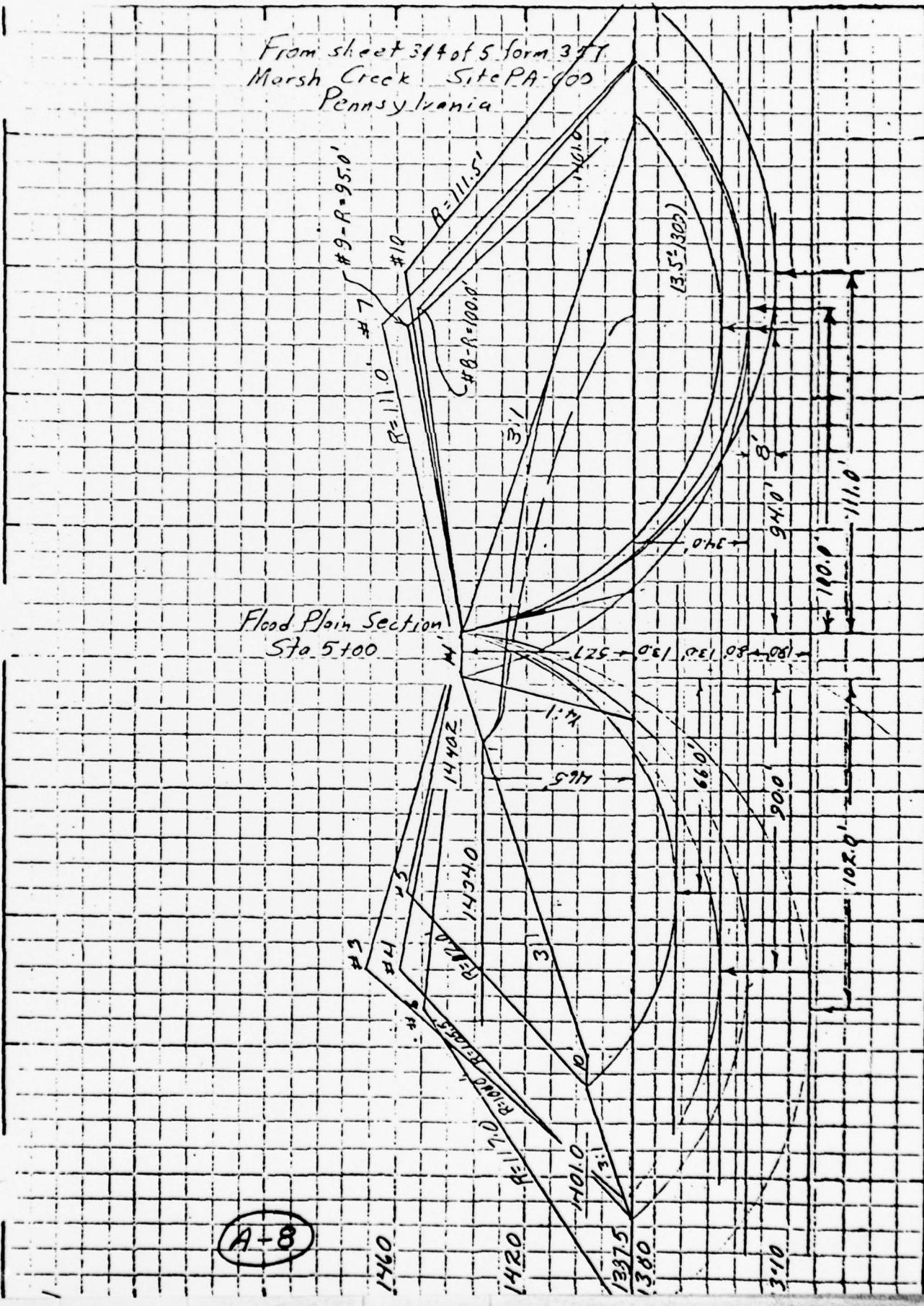
Trial	Slope	Conditions	Fs
3A	3:1	Full draw down - 10' berm @ El 1401 - Arc From 0 to Sh'd'r Through Panned Emb & 26' Found. (13½°-1300) - Sat Shear Values	1.75
4A	3:1	Same Conditions As Trial 3A Except The Arc Was Cut To A 34' Depth in The Foundation	1.71
5A	3:1	Same Conditions As Trial 3A Except A 13' Foot Foundation Depth Was Used	1.95
6A	3:1	Same Conditions As Trial 3A Except The Failure Arc Penetrated the Foundation To A 53 Ft. Depth	1.70

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
7D	3:1	No Drain - No Berm - Arc Cut From 0 to Sh'd'r Thru Panned Emb. And 34' Foundation (13½°-1300)	1.66
8	3:1	No Drain - No Berm - Arc Cut From Some Sh'd'r Thru Emb (33½°-150) & 34' Foundation (13½°-1300)	1.52
9	3:1	No Drain - No Berm - Arc Cut From Some Sh'd'r Thru Emb (33½°-150) & 26' Foundation (13½°-1300)	1.60
10	3:1	No Drain - No Berm - Arc Cut From Some Sh'd'r Thru Emb (33½°-150) & 42' Foundation (13½°-1300)	1.64
A-7			

To be used to report to field offices data used for slope stability analyses and the results of the analyses. The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

From sheet 34 of 5 form 35
Marsh Creek Site PA-603
Pennsylvania



SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIoga COUNTY
PENNSYLVANIA

KELSEY CREEK DAM
NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600
BOROUGH OF WELLSBORO
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

APPENDIX B
CHECKLIST - VISUAL INSPECTON

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Kelsey Creek County: TIOGH State: Pennsylvania
NDI ID No.: PA-00168 DER ID No.: 59-64

Type of Dam: Zoned Earthfill Hazard Category: High
Date(s) Inspection: 26 July 1979 Weather: Intermittent Rain Temperature: 65°F

SCS ID No. PA-600
Soil Conditions: Moist to Wet

Pool Elevation at Time of Inspection: 1401.0 msl/Tallwater at Time of Inspection: 1375.4 msl

Inspection Personnel:
Lindsey (SCS) D. Ebersole (GFCC)
J. Zainaylo (SCS) D. Wolf (GFCC)
A. Whitman (GFCC) Recorder

B-1

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	ERODING AREA 200' LT OF RIVER	 MINOR - SEE REGULAR EROSION FROM RIVER BEFORE TREATING
CREST ALIGNMENT: Vertical Horizontal	VERTICAL - SEE SURVEY DATA FOLLOWING IN SPECIFICATIONS HORIZONTAL - OK	
RIPRAP FAILURES	None	

B-2

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	None	
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	
VEGETAL COVER	GRASS GOOD - ABOUT 3 FEET HIGH	

R-3

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Across - $\frac{1}{2}$ inch No. of locations -	
INTAKE STRUCTURE	Submerged	
OUTLET STRUCTURE	Very minor spalling	
OUTLET CHANNEL	Impressed - in good condition	
EMERGENCY GATE	SCS Reports Gate opened during ANNUAL inspection with no problems.	

~~MAIN~~ SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good Condition	Because of location, close inspection not possible.
APPROACH CHANNEL	Reservoir	
DISCHARGE CHANNEL	Steep outlet works concrete	
BRIDGE AND PIERS	NONE	

~~AUXILIARY~~
~~GATED~~ SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE-SILL EARTHEN	No deficiencies.	▲
APPROACH CHANNEL	No deficiencies.	GRASS: About 3' HIGH
DISCHARGE CHANNEL	No deficiencies.	→
BRIDGE AND PERS	NONE	
GATES AND OPERATION EQUIPMENT	NONE	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF MONUMENTATION/SURVEYS	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	N/A	

B-7

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	CLEAR	
SLOPES	FATIGUE STEEP	
APPROXIMATE NUMBER OF HOMES AND POPULATION	At LETHUR 40 in WELLS BORO Alone	

RESERVOIR AND WATERSHED

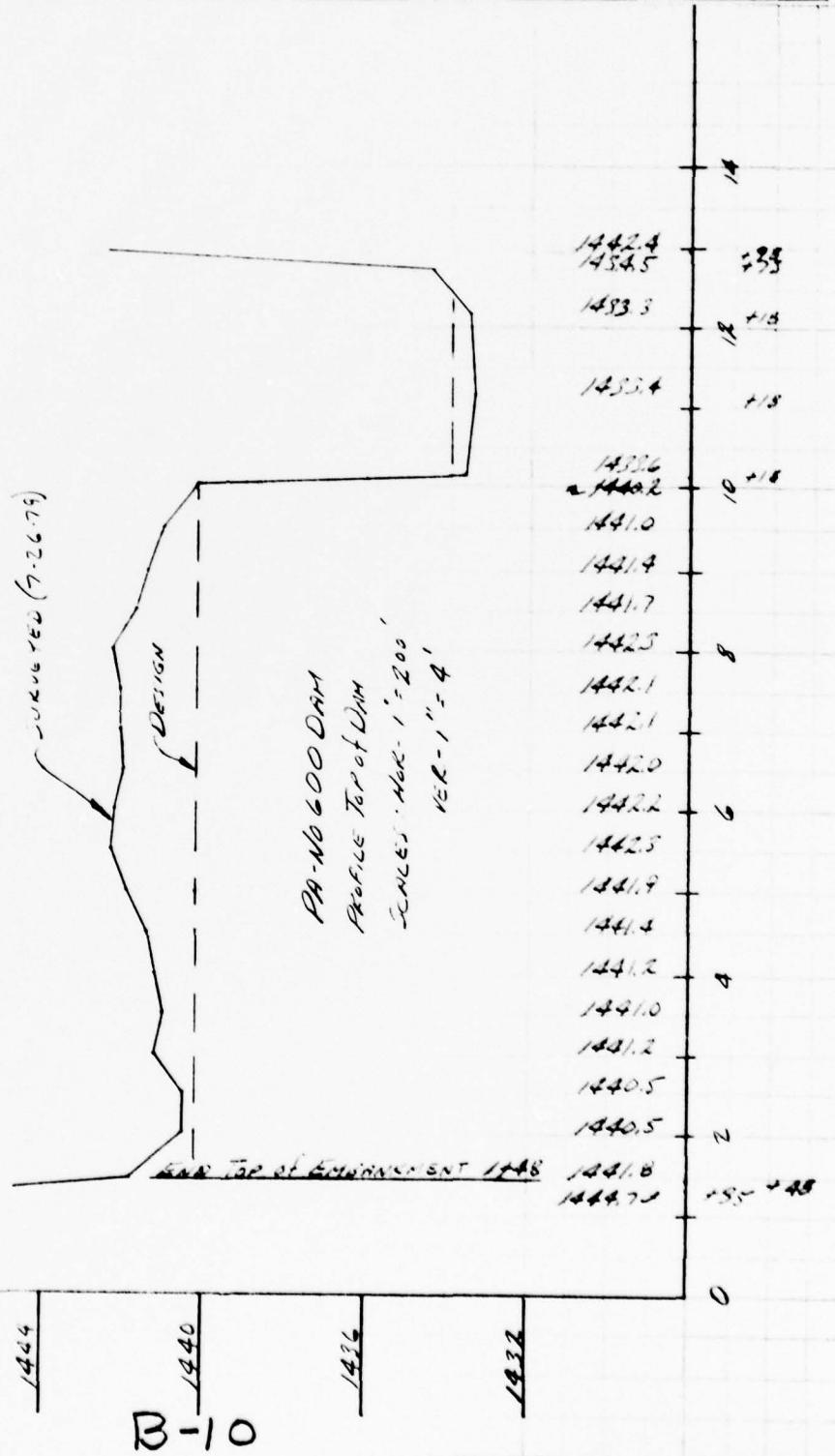
Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Fairly steep	
SEDIMENTATION	NO OBSERVED OR REPORTED PROBLEMS	
WATERSHED DESCRIPTION	WOODED ROLLING HILLS WITH MINOR DEVELOPMENT.	

B - 9

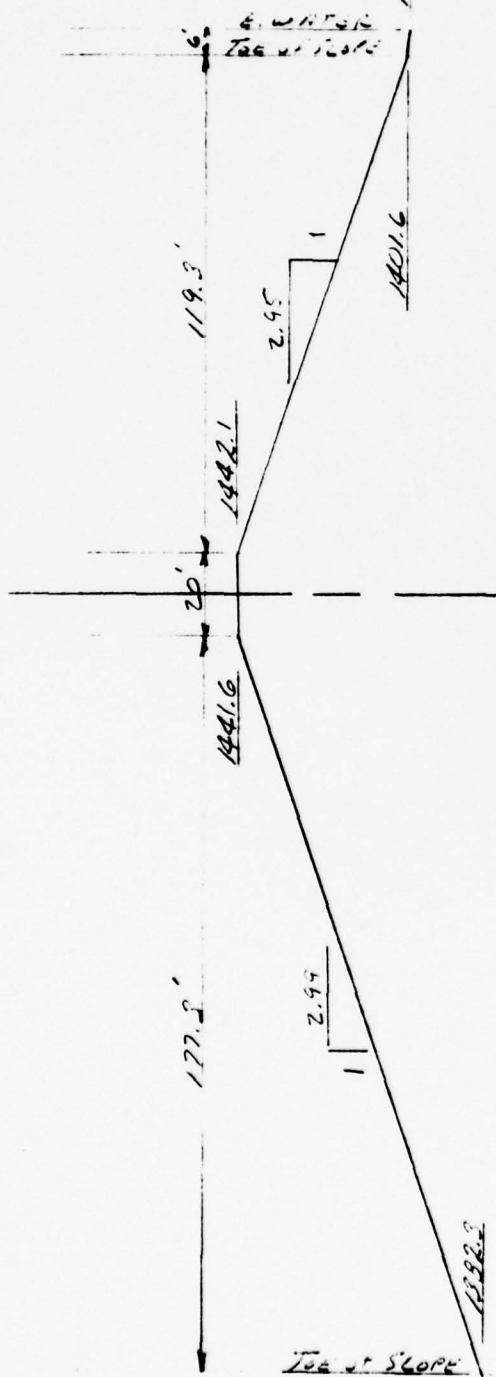
GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT PA 600 DAM FILE NO. _____
KELSEY CREEK SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



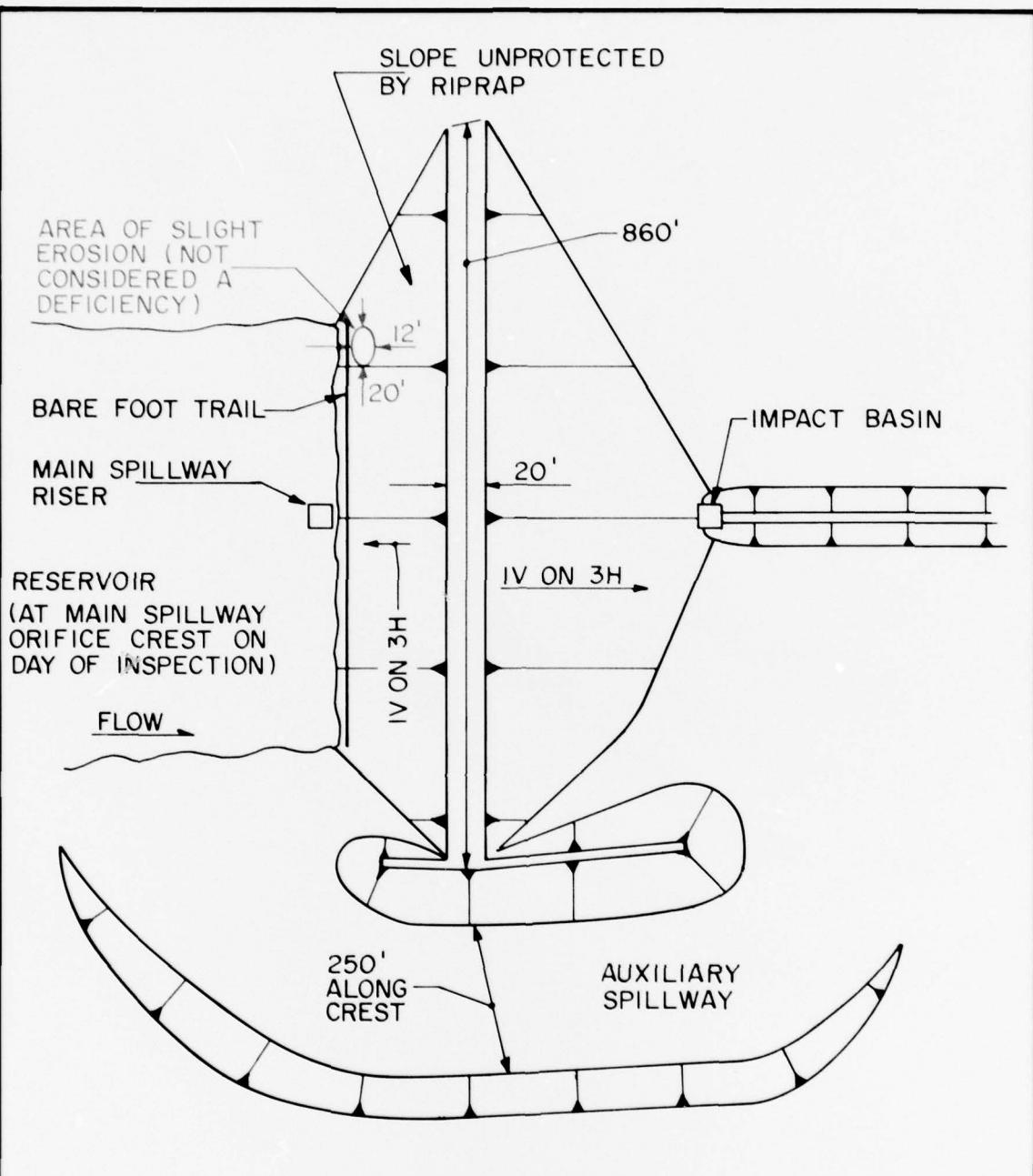
GANNETT FLEMING CORDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT PW-600 DRAWS
KELSEY CREEK
FILE NO. _____
SHEET NO. _____ OF _____ SHEETS
FOR _____
COMPLETED BY _____ DATE _____
CHECKED BY _____ DATE _____



PW-600 DRAWS
EXTINCTION SECTION
at Main Street
SCALE 1" = 40'

B-11



NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

KELSEY CREEK DAM

BOROUGH OF WELLSBORO

RESULTS OF VISUAL INSPECTION

AUGUST 1979

PLATE B-1

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM
NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600
BOROUGH OF WELLSBORO
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

APPENDIX C
HYDROLOGY AND HYDRAULICS

APPENDIX C

HYDROLOGY AND HYDRAULICS

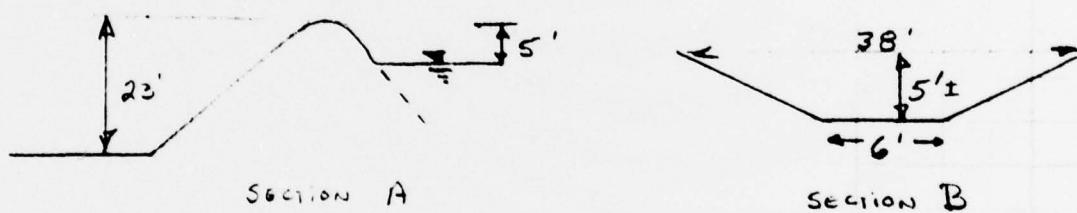
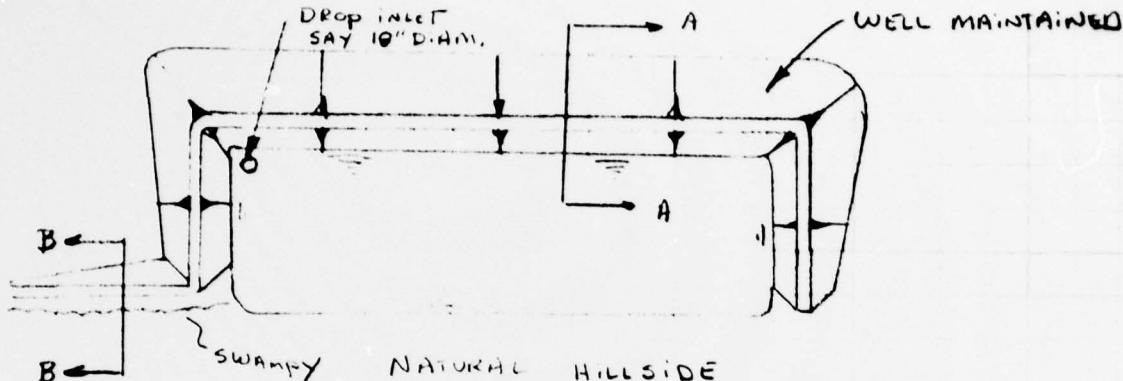
In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

- (a) There is a high hazard to loss of life from large flows downstream of the dam.
- (b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.
- (c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
FOR _____ SHEET NO. _____ OF _____ SHEETS
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

Impoundment in Kelsey Creek
DAM COUNTERSHED: (0.4 mi upstream from reservoir)



DRAINAGE AREA: 36 ACRES = .056 mi²
NORMAL POOL SURFACE AREA: 5.6 ACRES

$$S_{\text{NORMAL}} = \frac{\text{HEIGHT} \times \text{NORMAL POOL AREA}}{3} = 33.6 \text{ ACRE-FT}$$

TOP OF DAM SURFACE AREA: 6.0 ACRES[†]

TOP OF DAM STORAGE: 62.6 ACRE-FT.

C-2

1/13/59

155 E DUNAV

11/10/1958

155 E DUNAV

HYDROGRAPH COMPUTATION FORM

Watershed MARSH CREEK State PAStructure Site or Sub-area #1 KELSEYStorm Distribution Curve B Hydrograph Family 1D. A. 3.14 sq. mi., Pt. Rainfall 22.3 inches, Aerial Rainfall 20.5 inchesR. O. Condition H, R. O. Curve No. 75, Storm Duration or Freq. 6 HRS $T_c = 1.78$ hrs., $Q = 16.95$ inches, $T_p = 0.686$ $T_c = 1.22$, $T_o = 5.53$ hr. $\frac{T_o}{T_p}$ Computed = .453 $\frac{T_o}{T_p}$ used: 4 Revised $T_p = 1.58$ hr. $q_p = \frac{484A}{\text{Rev. } T_p} = 11.01$ c.f.s. $q_p \times Q = 18,695$ c.f.s. T (column) = $\frac{t}{T_p} \times \text{Rev. } T_p$ q (column) = $\frac{q_c}{q_p} (q_p \cdot Q)$ Check: $Q = \frac{(3t)(2q)}{695A}$

Table 3.21-7 (sheet 25 of 27)

Line No.	$\frac{t}{T_p}$	$\frac{q_c}{q_p}$	T hours	q c.f.s.	Line No.	$\frac{t}{T_p}$	$\frac{q_c}{q_p}$	T hours	q c.f.s.
1	0	0	0	0	21	7.00	.006	9.660	112
2	0.55	.003	0.493	56	22	7.5	.009	10.113	75
3	0.70	.015	0.966	280	23	7.70	.003	10.626	56
4	1.05	.049	1.449	916	24	8.5	.002	11.109	37
5	1.40	.122	1.932	2280	25	8.90	.001	11.592	19
6	1.75	.298	2.415	5571	26	8.75	.000	12.015	0
7	2.10	.528	2.898	9871	27				
8	2.45	.585	3.381	10937	28			29	7274
9	2.80	.618	3.864	9684	29				
10	3.15	.413	4.347	7721	30			9 = 12.00	
11	3.50	.334	4.830	6244	31			ERROR $\frac{.02}{12.00} = .12\%$	
12	3.85	.273	5.313	5104	32				
13	4.20	.231	5.796	4319	33				
14	4.55	.185	6.279	3459	34				
15	4.90	.128	6.762	2393	35				
16	5.25	.090	7.245	1496	36				
17	5.60	.047	7.728	879	37				
18	5.85	.028	8.211	523	38				
19	6.30	.017	8.694	318	39				
20	6.65	.010	9.177	187	40				

C-3

402-17-69

763-PA-S.

GANNETT FLEMING CORDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT SCS FILE NO. _____
FREE BOARD STORM SHEET NO. ____ OF ____ SHEETS
FOR KELSEY CREEK DAM
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SCS DATA (6 HR STORM)

RAINFALL = 20.5"

RUNOFF = 16.98"

Q PEAK INFLOW = 10,937 CFS

PMF DATA
SUQUE HANNA BASIN

DISTRIBUTION

6HR	118%	
12 HR	127	INDEX RAINFALL
24 HR	136	= 22.15"
48 HR	142	ADJUSTMENT = 99%
72 HR	145	

(FROM HYDROMET 40)

Revised INDEX = $22.15 \times .99 \times .8 = 17.54''$
Hop Brook Factor \uparrow

TOTAL 6 HR RAINFALL = $1.18 \times 17.54 = 20.70''$

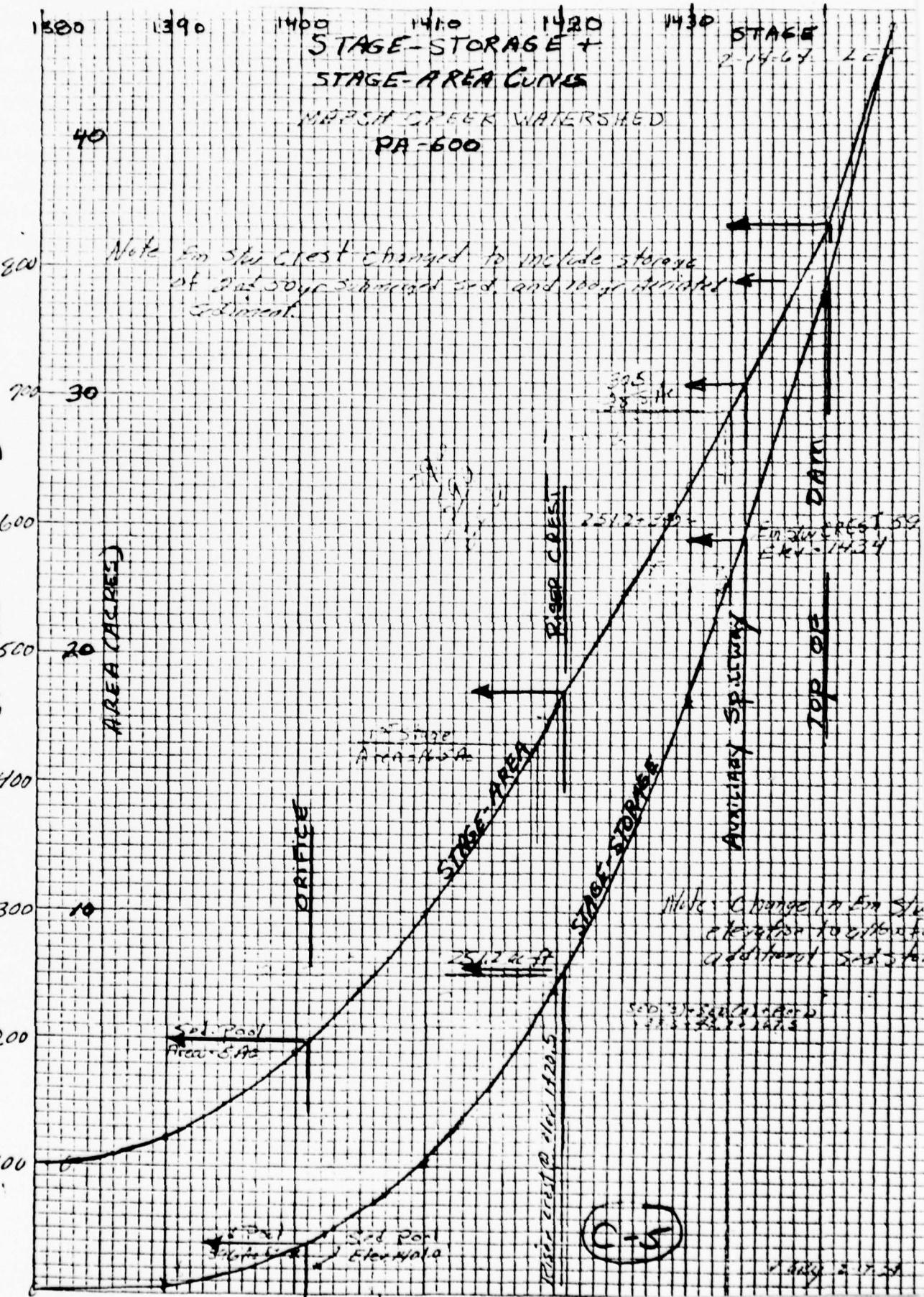
As small (e.g. 3.14 mi²) WATERSHEDS
ARE ONLY SENSITIVE TO INTENSE (e.g. PEAK)
RAINFALL PERIODS, THE SCS 6-HR RAINFALL
IS SUFFICIENTLY CLOSE TO THE PMF

SINCE THE INITIAL ABSTRACTION OF
1.0" IS ASSUMED TO HAVE BEEN ABSORBED
BY THE LIVELY PART OF THE PMF, FOR
THE 6-HR PEAK: RUNOFF = $20.70 - 6 \times .05$ INCHES/HR
= 20.40", THIS IS SLIGHTLY GREATER THAN
THE SCS RUNOFF OF 16.4". HOWEVER, THE
PEAK FLOW IS CONSERVATIVE BECAUSE THE
UNIT HYDROGRAPH IS CONSERVATIVE.

C-4

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



MARSH CREEK WATERSHED PA-600

STAGE-Discharge Calculations 2-18-64 LET

Elv	H _o	H _o ^{1/2}	Q _o	H _w	H _w ^{3/2}	Q _w	H _p	Q _p	Q _{min}	q _c	H _p
			= 235 H _o ^{1/2}	Elev-1405		56.8 H _o ^{3/2}	Elev-1392.5	-26.2 H _o ^{1/2}		ES-124 SL 317 L-200	
1401.0	0	0	0						0		
1405.0	2	1.41	33.2		Base flow elev = H _o ^{1/2} = 16 = 68			33.2			
1405.2	4	2	47.0				23.5		47.0		
1408.3	7	2.65	62.3		H _o = .83; Base flow elev			62.3			
1410.2	9	3	79.5		= 1401.83			79.5			
1415.7	14	3.74	88.0					88.0			
1419.5	16.7	4.09	96	0				96			
1419.0	17.2	4.15	98	0.5	0.354	19.8	36.5	158.5	117.8		
1420.0	18.2	4.27	100	1.5	1.83	102	37.5	160.5	160.5		
1425.0	23.2	4.82	113	6.5	14.711.6 920 ^{2/3}	42.5	171.0	171.0			
1428.0						45.5	172.0	172.0			
1430.0						47.5	181.0	181.0			
1433						50.5	186.0	186.0	0		
1434.76						52.26	190.0	190.0	5 1.76		
1435.65						53.15	192.0	192.0	10 2.65		
1436.39						53.89	192.5	192.5	15 3.39		
1437.04						54.54	194.0	194.0	20 4.04		
1438.14						55.64	196.0	196.0	30 5.14		
1439.14						56.64	197.0	197.0	40 6.14		
1440.00						57.5	199	199	50 7.0		
1440.83									60 7.83		
1441.2	0.5	0.77	17		Base flow elev.						

CULTURE
RVICE

SEE NOTE ON PLATE C-2

O - 14

ES-124 SH 3/4 L-20:	ES-9P SH 1/4	2:2	b=200				
90 H0	do	2dc	2dc+8	Open	Gates	Stones	
							0 1401.0
							172 1403.8
							31.0 1405.0
							46.3 1407.8
							63.5 1410.8
							72.0 1415.8
							90.0 1418.5
							1078 1419.0
							144.5 1420.0
							155.0 1425.0
							161.0 1428.0
							165.0 1433.0
0							170.0 1433.0
5 1.76	0.91	1.82	251.8	12,57	1433.0	1434.76	
10 2.05	1.46	2.92	252.9	2,529	2705.0	1435.65	
15 3.39	1.91	3.82	253.8	3,807	3183.5	1436.39	
20 4.04	2.33	4.66	254.7	5,094	5372.0	1437.04	
30 5.14	3.05	6.10	256.1	7,683	7262	1438.14	
40 6.14	3.70	7.20	257.2	10,288	104377	1439.19	
50 7.0	4.13 ²⁶	8.26	258.3 ²⁷	12,915	13.13	1440.00	
60 7.83	4.95	9.70	259.7	15,582		1440.83	
					1	1402.3	
				Very	2-12.3		

NOTES ADDED
by GFCC:

ORIFICE CREST

RISER CREST *

AUXILIARY SPILLW
CREST

* NOTE:
ELEVATIONS CHA
AFTER ROUTINGS
COMPUTED.

EL. 1439.2 = TOP OF DA

PHASE I INSPECTION RE
NATIONAL DAM INSPECTION

KELSEY CREEK D
BOROUGH OF WELLSB

HYDRAULIC COMPUTA

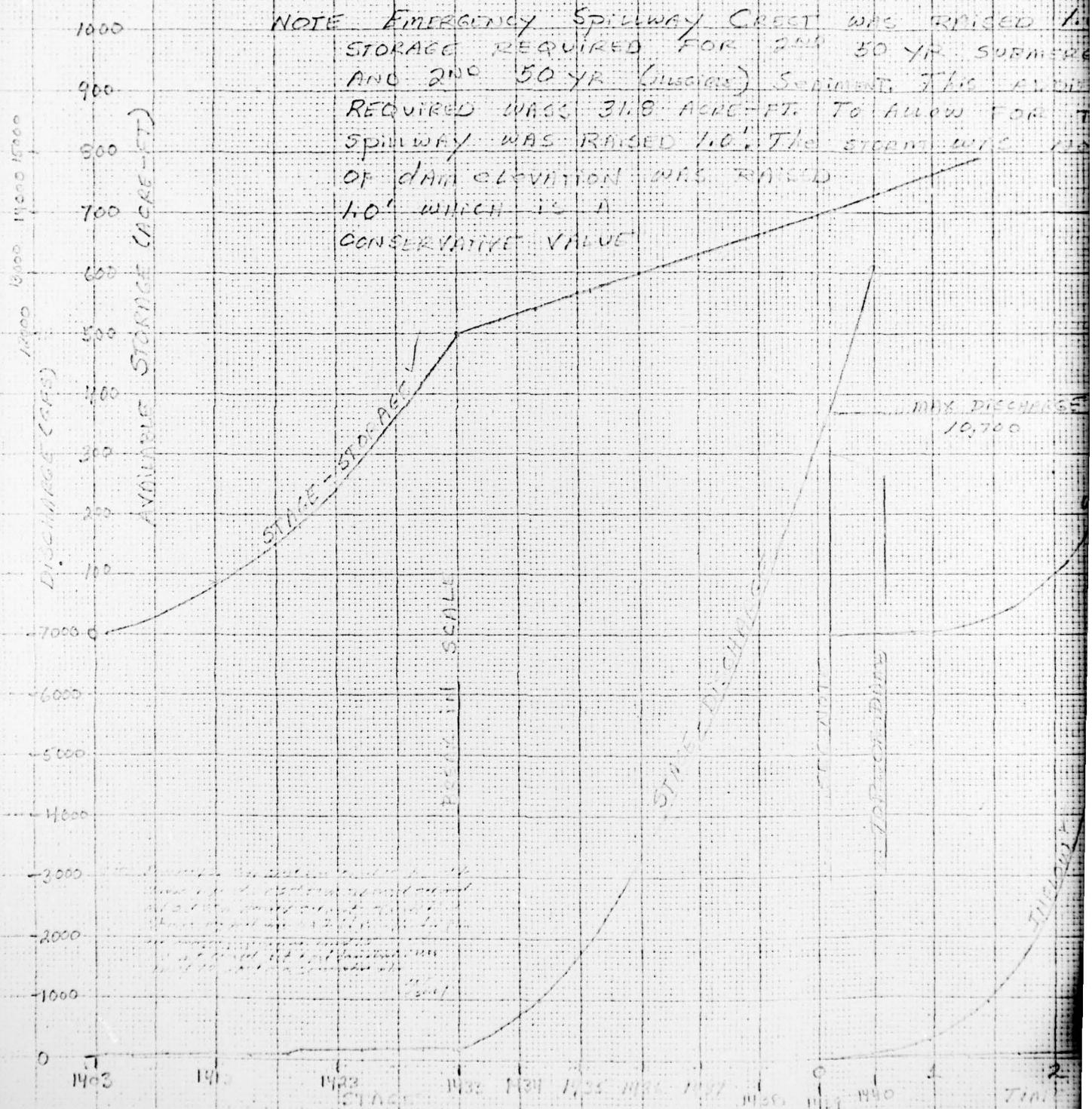
AUGUST 1979

E C-2

NOTES ADDED
by GFCC:

- 1401.0 ← ORIFICE CREST
1403.8
1405.0
1408.8
1410.8
1415.8
1418.5 ← RISER CREST *
1419.0
1420.0
1425.0
1428.0
1430.0
1433.0 ← AUXILIARY SPILLWAY *
1434.76 CREST
1435.65
1436.39 * NOTE:
ELEVATIONS CHANGED
AFTER ROUTINGS
COMPUTED.
1437.04 3
1438.14
1439.19 ← EL. 1439.2 = TOP OF DAM *

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM KELSEY CREEK DAM BOROUGH OF WELLSBORO HYDRAULIC COMPUTATIONS	
AUGUST 1979	PLATE C-1



B-9

DISCHARGED 1.0' TO INCLINE
SUMMER GROWTH SEDIMENT
ADDITIONAL STORAGE
ON THIS DAY THE EMBANKMENT
WAS REACHED BUT TOP
X DISCHARGE 10,700

10,937 cfs

50-14-A
FILE NUMBER
RECEIVED IN THE OFFICE OF THE WILDER & POWERS
RESOURCES BRANCH DEPARTMENT OF FOREST
WATERS ON THIS DAY OF 1979 AD 1979
Antithesis

RECD BY
BEE REPORT NO.
DRAFT

4/13/55
E. A. C. K. W. C. S. S.
Cutter Engineer

FREEBOARD HYDROGRAPH

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TIME (HOURS)

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
KELSEY CREEK DAM
BOROUGH OF WELLSBORO
FREEBOARD STORM ROUTE
AUGUST 1979 PLATE

144 / *144* / *1440* / *1436* / *1432*

B-10

59-14-18
FILE NUMBER

IN THE OFFICE OF THE WILDER & POWERS
CIVIL ENGINEERS
DEPARTMENT OF FORESTS
FOR THE STATE OF PENNSYLVANIA
August 1979 AD 1979

PORT NO.

FR.

DR. DRY

937 GFS

HYDROGRAPH

AGRICULTURE
SERVICE

e/a C. H. McCormick - 1979
Clear Lake

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
KELSEY CREEK DAM
BOROUGH OF WELLSBORO
FREEBOARD STORM ROUTING
AUGUST 1979 PLATE C-2

To be scored

B-11

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIoga COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

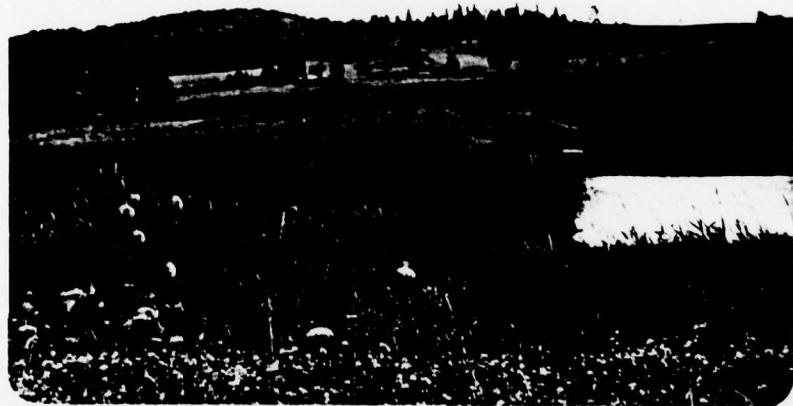
APPENDIX D
PHOTOGRAPHS

RESULTS OF VISUAL INSPECTION

AUGUST 1979

PLATE B-1

KELSEY CREEK DAM



A. Upstream Slope



B. Downstream Slope

KELSEY CREEK DAM



C. Main Spillway and Auxiliary
Spillway Approach Channel



D. Impact Basin

C-1

KELSEY CREEK DAM



E. Auxiliary Spillway Crest



F. Dike at Auxiliary Spillway Exit Channel

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIoga COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

APPENDIX E

GEOLOGY

KELSEY CREEK DAM

APPENDIX E

GEOLOGY

1. General Geology. The Damsite and Reservoir are located in Tioga County. With the exception of the southwest corner the entire county was glaciated during the Wisconsin glacial advance. Glacial features such as lakes, marshes, moraines, and terraces are almost lacking in the uplands of Tioga County. However, in the valleys, abundant evidence of glaciation has been preserved, particularly in the valleys of the Tioga and Cowanesque Rivers and along Marsh Creek, Crooked Creek, and Upper Pine Creek. Drainage from glacial lakes in these valleys resulted in what is called the Pine Creek Gorge. A geologic map is presented on Plate E-1.

The rock formations exposed in Tioga County range in age from the Chemung Formation of Upper Devonian age to the Allegheny Formation of Pennsylvanian age. The oldest rocks crop out in three broad anticlinal folds in the north, central, and southern parts of the county. The youngest rocks are exposed in the Blossburg Coal Basin. Most of the plateau remnants are capped by the Pocono Formation, with smaller remnants of the Pottsville Formation. The intermediate slopes are underlain by the Cattaraugus and Oswayo Formations.

The geologic structure of Tioga County displays a series of well defined folds with marked continuity trending east-northeast. Evidence of doming is observed on the Sabinsville, Wellsboro, and Towanda anticlines. In all the domed areas the south limb is appreciably steeper than the north limb. The regional plunge of the folds is to the southwest and generally they decrease in amplitude with distance from the Allegheny Front. Surface evidence of faulting is observed on the south flank of the Sabinsville Anticline in Tioga Township, on the Wellsboro Anticline southeast of Wellsboro, and on the Towanda Anticline in Union Township. Subsurface faults have been noted during drilling of some deep wells in the area.

2. Site Geology. The dam is founded on marine beds of Devonian age. The dam is situated in the Allegheny High Plateau Province. Structure in the area is primarily that of a dissected plateau of moderate relief and gently sloping hills. Rock strata in the area are essentially horizontal. The marine beds are composed chiefly of fine-grained sandstone and siltstone with some interbedded shale. Bedding is generally well developed and thin. Joint systems are usually regularly spaced and dip steeply. The dam is founded on overburden. Excerpts from the design analysis for the foundation materials are attached hereafter.

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State Fergus-Lyon County, Iowa Watershed Marsh Creek Subwatershed Kelsey
Site number 21-600 Site group I Structure class C Investigated by Daniel J. Johnson
(Signature and title) 1964

INTERPRETATIONS AND CONCLUSIONS

The major problem in design and construction on this site appears to be the unstable nature of the material in the upstream portion of the emergency spillway. Ground water in some of the SI and GI strata is under pressure and rises when capping horizons are penetrated with drill holes. Some type of drainage probably can be installed to create stable slopes, but such drainage is certain to effect the two domestic water wells located uphill from the spillway. The two wells were described by one of the landowners as being barely adequate under present conditions. Also the wet nature of these SI and GI soils will present some construction problems in excavation and in compaction in the fill.

The discharge from several small springs and seeps traverse the surface of the emergency spillway and these small streams have created areas of wet OL soils ranging from 0.5 to 2.0 feet thick on the surface. This condition is related to the water bearing SI and GI strata described in the first paragraph.

A second possible problem is a differential settlement between the varved lacustrine deposit and the very dense SI and GI interglacial alluvium found in the right abutment. It is hoped that an analysis of this can be made at the Soils Mechanics Laboratory using three Shelby samples and standard penetration data found in the logs of test holes. If this differential proves to be a major problem, the structure could be moved downstream on the right side of the valley so that the interglacial alluvium would not be in the foundation.

Borrow material as described under the discussion of the emergency spillway is of three general types: (1) Lacustrine (CL and some ML); (2) Glacial till (CL and some GC); and (3) Interglacial alluvium which consists of interbedded GI, SI and ML. The lacustrine is being proposed for the core zone of the fill and the till and interglacial alluvium are proposed for the shell portion. All of the materials appear to have adequate properties for use as proposed. Soils Mechanics Tests will be made on samples of each material to verify this conclusion.

The emergency spillway excavation will supply approximately 80% of the needed fill. Similar soils are available in sufficient quantity and can be borrowed from the pool area or between the pool area and the inlet to the emergency spillway.

Another possible problem is the termination of the permeable interglacial alluvium within the foundation. Water from the pool area will have an inlet into this horizon but there is no outlet downstream from the dam. This could cause critical uplift pressure within the foundation. Again the solution for this problem if it exists is to move the right end of the structure downstream so that the interglacial alluvium will be located entirely upstream from the structure.

No problems are anticipated in the construction and operation of the principal spillway. The foundation will have some settlement which can be predicted after testing the undisturbed samples. It should be mentioned here that a hole was drilled at station 5+00--130 ft. upstream but was not logged due to inadequate samples. Some piping was noted during the drilling of hole 302 and the one just mentioned so that the foundation may be disturbed as much as 20 feet away from these holes. It is suggested that the axis of the spillway be moved at least 20 feet left of its proposed location so that the riser will be on undisturbed soil. There will be no other significant differences between the foundation at this new location and the location that was investigated.

